



Chapter 3

The Biodiversity Challenge in an Expanding Region

3.1

How we got where we are today

3.1.1 Natural history

The natural history of the Chicago region prior to the arrival of the European settlers in the 1800s is well told in the companion document to this plan, *An Atlas of Biodiversity*, published by Chicago Wilderness in 1997. It describes the geologic evolution of the Chicago region, emphasizing the impacts of past glacial periods, and the evolution of natural communities following the last glacial retreat about 13,000 years ago.

Of most significance for planning the recovery of the region's biodiversity is the fact that its early-history produced a variety ecosystems, each raising its own distinct set of challenges for preservationists and land managers. The current classification system, described in chapter 4, recognizes four main types of forested communities, two of savanna, two of shrublands, four of prairie, and six of wetlands, as well as cliffs and lakeshores. Each of these was largely shaped by a unique combination of geology (including soils), climate (including variations in both temperature and moisture), and frequent exposure to fire (whether triggered by lightning or by Native Americans), all of which had prevailed for thousands of years. Another important factor was this region's flat terrain, which made the area prone to surface and over-bank flooding. This flooding, in turn, produced intermittent streams and wetlands, each supporting its own unique complex of native species. While the terrain was generally flat, subtle variations in topography produced hydrologic differences that gave rise to different hydric regimes of prairies, wetlands, savannas, and forests. Wind patterns and the resulting water currents along the shores of Lake Michigan produced a highly specialized dune ecology.

3.1.2 Human history

The earliest evidence of human activity in the Chicago Wilderness area dates to approximately 12,000 years ago, when highly nomadic Paleo-Indian clans came primarily to hunt larger animals at upland bogs and sloughs. The Paleo era lasted until 8000 B.C. and was followed by the cultural periods called Archaic-Indian (8000 to 600 B.C.), Woodland-Indian (600 B.C. to A.D. 900), and Mississippian-Indian (A.D. 900 to 1640). During these eras of prehistory, people gradually shifted from total dependence on hunting and gathering (Paleo and Archaic) to a more settled culture that incorporated agriculture (Woodland, and especially Mississippian). In these prehistoric periods, the peoples necessarily lived in total dependence on the local ecosystems. They helped shaped the character and health of natural communities through practices, such as setting fires, that supported their procurement of food, medicine, and materials important to their daily lives.

About 1640, European and French-Canadian trade goods were incorporated into local cultures. By the 1670s, French-Canadian trappers and traders used the area. The first recorded visitors were members of the Marquette and Joliet expedition in 1673, who were on their way back to Ft. Michilimackinac after "discovering" passages to the Mississippi via both the Wisconsin and Illinois rivers. In the 1680s, LaSalle and Tonti spent more time in the region and left the first extensive written description of its flora and fauna.

Although the region was visited in the 1700s by French and British military personnel, continuous settlement by cultures other than the Native Americans began only in 1779 with Du Sable. From this period until the early 1830s, many Pottawattomie, Sauk, and Winnebago people continued remnants of their previous, uninfluenced cultures. The incoming European-American-African culture absorbed much indigenous knowledge of the uses of

plants, animals, and local materials. Throughout the 19th century, many vestiges of this knowledge were still in common use, but as agriculture transformed the landscape and native landscapes disappeared, most of it was lost or not in widespread practice.

In 1831, Cook County was incorporated. In 1833, 8,000 Native Americans were displaced to west of the Mississippi River. Between 1830 and 1835, the settlement around the mouth of the Chicago River grew from 200 to 3,265 people. By 1840, thousands lived in the city and an increasing number settled the countryside. In 1838, 100 bushels of wheat were shipped out; in 1842, this had grown to 600,000 bushels.

The settlement and growth of Chicago has been attributed largely to its location at a national transportation crossroads. Indeed, regional and national canals and railroad systems generated commercial activity and spurred settlements throughout the Chicago region. But a revolution in farming technology had an even greater impact on the vast surrounding prairies. During the 1840s, John Deere and others began to produce a steel plow that finally made it possible for farmers to break up the soils of the deep-rooted tallgrass prairies.

Farmers also felt compelled to suppress fires. They plowed firebreaks and mowed fields that might otherwise burn. Absent fire, woody plants and trees had the opportunity to spread into any lands not used for buildings, crops, or pasture. Livestock grazed in remnant wooded areas, further altering the local ecology.

The loss of prairies and forests through fire suppression and physical reduction by the plow and ax was accelerated by the introduction of Old World plant species. Species including buckthorn, honeysuckle, and multi-flora rose successfully competed with native species, and the suppression of fire allowed some native species to expand into new areas. Prairies and savannas became filled with gray dogwood, hawthorn, and box elder; woodlands and forests became dominated by box elder, maple, ash, elm, and other fire-sensitive trees. The increase in both canopy and understory species greatly reduced the available sunlight reaching species growing at ground level, including oak and hickory seedlings. Graminoids and flowers also suffered as shade increased. As the composition of the vegetation changed, insect species were often adversely affected, in some cases causing losses in turn to both flora and fauna that depended upon specific insects. Finally, the loss of native, flammable undergrowth has even limited the ability of fire to effectively remove understory brush.

Farmers and their village cousins learned to drain or fill wetlands that would otherwise interfere with the plant-

ing of crops or the construction of buildings. This practice eventually led to the loss of over 95% of the region's wetlands. Meandering streams were viewed as a cause of local flooding and a waste of valuable land, a problem that could easily be solved by straightening or channelizing the streambed. Both techniques destroyed natural habitat.

Rivers, streams, and even lakes were considered part of a cost-free disposal system. Untreated sewage and toxic wastes were routinely discharged into waters that had previously supported abundant fisheries and numerous other aquatic species.

Harbors and rivers were dredged and, in 1836, the Illinois and Michigan canal project began, spurring another population boom. Even as the canal was beginning operations in 1848, the railroad industry was taking steps toward making Chicago the focal point for operations serving the entire middle and far western regions of the country.

The evolution of human interaction with natural communities has been paralleled by an evolution of understanding of that interaction. Settlers may not have intended to cause the local extinction of so many species, perhaps only wolves, bears, and other animals that posed a direct threat to their own lives or property. It took several decades of rapid decline of the native landscape before local leaders recognized the need for a system of forest preserves throughout Cook County.

In 1894, a nationally prominent landscape architect, Jens Jensen, began to prepare maps of what he thought should be preserved. In 1904, Cook County Board Chairman Henry Foreman, Jensen, architect Dwight Perkins, and others published *The Outer Belt of Forest Preserves and Parkways for Chicago and Cook County*. In 1913, the Illinois General Assembly passed enabling legislation authorizing the creation of forest preserve districts in counties other than Cook. In 1915, the General Assembly finally enacted legislation establishing a system of publicly owned preserves in Cook County. Another famous contributor to this campaign was architect and planner Daniel Burnham who, with fellow architect Edward Bennett, published the *Plan of Chicago*. Building upon the recommendations of Foreman, Jensen, and Perkins, this work proposed, among other things, an extensive system of regional parks. The motivation behind this plan is revealed in the following passage from the Plan of Chicago:

The grouping of manufacturing towns at the southern end of Lake Michigan, and the serious attempts that have been made (especially in Pullman and Gary) to provide excellent living conditions for people employed in larger operations,

create a demand for extensive parks in that region; because no city conditions, however ideal in themselves, supply the craving for real out-of-door life, for forests and wild flowers and streams. Human nature demands such simple and wholesome pleasures as come from roaming the woods, for rowing and canoeing, and for sports and games that require large areas. The increasing number of holidays, the growing use of Sunday as a day of rest and refreshment for body and mind tired by the exacting tasks of the week, together with the constant improvement in the scale of living, all make imperative such means of enjoyment as the large park provides. Therefore, adequate provision for the growing populations that of necessity must live in restricted town areas requires that in the region south and southwest of Chicago all those marsh lands and wooded ridges which nature has thus far preserved from being taken for manufacturing purposes now should be secured for the parks that in the next generation will be required, but which will be beyond reach unless taken in the immediate future.

The development of a system of outlying large parks along the lines above indicated will give to Chicago breathing spaces adequate at least for the immediate future; the physical character of the lands to be taken will insure a diversity in natural features most pleasing and refreshing to dwellers in cities; and the acquisition of the areas entirely around the present city will afford convenient access for all the citizens, so that each section will be accommodated. Moreover, the development of especially beautiful sections, such as the region about Lake Zurich, will give marked individuality to Chicago's outlying park system. It is by seizing on such salient features of a landscape and emphasizing their peculiar features that the charm and the dignity of the city are enhanced.

Thus, the very process of metropolitan population growth during the early part of the 20th century established the demand and, not so incidentally, the tax base that were essential precursors to today's system of forest preserves and protection of the remnant natural communities they contain. It follows that the demands of a newly growing regional population for recreation, coupled with growth in the tax base and loss of open space (mostly to suburban development) make the attainment of this plan's goals most realistic.

While Perkins, Jensen, Burnham, et al. were making their plans, a professor, Henry Chandler Cowles, was initiating a new science of ecology at the University of Chicago. Christy (1999) writes:

Cowles's pioneering work over several decades established the concept that a native landscape is really a highly diverse group of plant communities, the "residents" of each community adapted to one another and the community as a whole requiring specific physical factors—water, light,

drainage, fire—to survive and thrive. Cowles's work also revealed what has been confirmed ever since: that the Chicago region is one of the most biologically rich areas in America.

By 1922, the Cook County Forest Preserve District had acquired 21,500 acres, roughly a third of its present-day holdings. Acquisition of preserves progressed more slowly thereafter until the national environmental movement of the 1960s inspired a federal program of grants for open-space acquisition. All of the region's forest preserve and conservation districts took advantage of this program. Between 1960 and 1981, the inventory of state parks and county preserves in Illinois nearly doubled from 64,123 acres to 123,101 acres. The 1999 total stands at 165,724 acres, plus the 19,000-acre Midewin preserve and various sites in northwest Indiana and southeast Wisconsin. One outcome of the generous federal matching grants for open space preservation, when combined with the rapid rate of suburban development, was that local districts assigned a higher priority to land acquisition than to land management. Moreover, the realization has only come recently that our natural communities deteriorate when left unmanaged.

In the 1940s, University of Wisconsin professor John Curtis began experimenting with the restoration of native plant communities. But it was not until 1962 that Morton Arboretum biologist Ray Schulenberg launched the world's second major ecosystem restoration: a 100-acre prairie that today contains 350 species of native plants. Schulenberg notes that while the prairie is now self-sustaining, it still lacks a number of plant and insect species that would be found in a natural prairie.

The national environmental movement begun in the 1960s also featured federal grants for the abatement of water pollution, a vital factor in preserving aquatic habitat throughout the region. It was also in the 1960s that local preservationists and planners began to explicitly evaluate potential preservation sites according to the number of benefits presented, thereby increasing the return on the taxpayers' investment. For example, a stream and its adjacent floodplain might offer opportunities for fishing while also recharging groundwater and precluding the flood damages that would have resulted from urbanization. A stream in its natural state would also offer aesthetic benefits and enhance the values of adjacent properties. A site containing all these features would clearly outrank a site containing only cultivated fields.

An example of this kind of analysis can be found in the report prepared by the Northeastern Illinois Planning Commission for the DuPage County Forest Preserve Commission in 1965. The report recommended adding

19 sites totaling 8,714 acres to the 2,350 acres of existing DuPage County forest preserves. Woodlands, marshes, and remnant prairies were among the landscape features identified in that plan. Yet, even in a report so recent, the further loss of biodiversity in this region was not recognized as an impending threat.

Another important step for our natural areas came with the establishment in 1963 of the Illinois Nature Preserves system. The first nature preserve designation was given to the Illinois Beach Nature Preserve in 1964. There are currently 105 designated sites in northeastern Illinois, many of which are lands owned by county forest preserve or conservation districts. Once a site is designated, the Illinois Nature Preserves Commission and the Department of Natural Resources provide technical assistance to the property owner to help preserve the natural communities contained therein. The identification of appropriate sites for designation has been an outcome of the Illinois Natural Areas Inventory, completed in its initial form in 1978.

Americans have long expressed concern for the plight of African wildlife, the destruction of the Amazon rain forests, and the uncertain fate of the American wilderness widely thought to exist only in the remotest parts of the Far West and Alaska. Yet the history of this region throughout the twentieth century also demonstrates a prevailing public interest in preserving nature here, however that term has been understood.

3.2

Current status and future of metropolitan-wide development

3.2.1 Forecasts for growth in the Chicago Wilderness region

Although recent years have seen the increasing use of best management practices and best development practices to ease the negative impacts of metropolitan growth on our valued natural resources, the continuing expansion of human development in the Chicago Wilderness region still carries with it many threats to biodiversity. Foremost among these is the sheer paving over of open space by new development. Subsequently, the Chicago Wilderness metropolitan region has experienced increases in flooding, more contamination of streams due to urban runoff, and a continuing encroachment on wetlands and other natural habitats.

Official forecasts to the year 2020 by regional planning agencies paint a picture of substantial growth amidst uneven growth pressures in the Chicago Wilderness region. Table 3.1 presents these forecasts, developed by the regional planning commissions for Illinois, Wisconsin and Indiana. For the six-county northeastern Illinois area, the population is expected to increase by 25% while employment increases by 37%. The expected population growth rate in Kenosha County, Wisconsin, is nearly as great (24%), while the northwest Indiana counties should grow at a more modest level (9%). The forecasted employment growth in Kenosha County (39%) is even greater than that in northeastern Illinois. The northwestern Indiana region's employment growth is expected to be 19%.

3.2.2 Past patterns of regional decentralization

The population of the six-county northeastern Illinois area between 1970 and 1990 increased by only 4% and employment increased by 21%, while the amount of land in urban uses increased by 33% during the same period. Thus, while regional population growth was moderate, its impacts were substantial because of the way the growth was distributed. The population of the growing suburban areas in Illinois increased by 24% or almost 1 million, while the City of Chicago and 89 suburbs lost about 770,000 people. Similar patterns occurred in Wisconsin and Indiana.

Development in the Illinois six-county area from 1970 to 1990 converted over 450 square miles of agricultural and vacant lands to residential and employment uses. This high rate of land consumption, which also occurred in the Wisconsin and Indiana portions of the Chicago Wilderness region, reflected the generally larger lot sizes that have characterized residential, commercial, and industrial development and redevelopment throughout the region. It also reflected a high rate of household formation relative to population increase as household sizes declined. The overall pattern was one of a few more people occupying a lot more land.

3.2.3 The challenge of sustainability

Recent information suggests that the pattern of sprawling growth in the Chicago Wilderness region is continuing. The U.S. Census Bureau estimates that northeastern Illinois's population has increased by as much since 1990 as it had in the preceding twenty-year period (1970–1990). The outer suburban areas throughout the Chicago Wilderness region are developing rapidly, adding housing at unprecedented rates and employment-based development as well. At the same time, the City of Chic-

Table 3.1
Growth Forecasts for the Chicago Wilderness Region¹

| POPULATION | 1990 | 2020 | 1990–2020 | % Change |
|--|------------------|------------------|------------------|------------|
| Northeastern Illinois² | | | | |
| Chicago | 2,783,726 | 3,005,338 | 221,612 | 8% |
| Suburban Cook County | 2,321,318 | 2,589,061 | 267,743 | 12% |
| Du Page County | 781,689 | 985,701 | 204,012 | 26% |
| Kane County | 317,471 | 552,944 | 235,473 | 74% |
| Lake County | 516,418 | 827,564 | 311,146 | 60% |
| McHenry County | 183,241 | 361,598 | 178,357 | 97% |
| Will County | 357,313 | 722,794 | 365,481 | 102% |
| Total | 7,261,176 | 9,045,000 | 1,783,824 | 25% |
| Southeastern Wisconsin | | | | |
| Kenosha County | 128,200 | 159,600 | 31,400 | 24% |
| Northwestern Indiana | | | | |
| Lake County | 475,594 | 509,229 | 33,635 | 7% |
| Porter County | 128,293 | 157,828 | 29,535 | 23% |
| LaPorte County | 107,066 | 111,000 | 3,934 | 4% |
| Total | 710,953 | 778,057 | 67,104 | 9% |
| EMPLOYMENT | 1990 | 2020 | 1990–2020 | % Change |
| Northeastern Illinois² | | | | |
| Chicago | 1,482,381 | 1,745,495 | 263,114 | 18% |
| Suburban Cook County | 1,293,652 | 1,773,881 | 480,229 | 37% |
| Du Page County | 530,322 | 815,178 | 284,856 | 54% |
| Kane County | 145,205 | 223,040 | 77,835 | 54% |
| Lake County | 228,606 | 393,641 | 165,035 | 72% |
| McHenry County | 65,526 | 106,336 | 40,810 | 62% |
| Will County | 99,393 | 222,429 | 123,036 | 124% |
| Total | 3,845,085 | 5,280,000 | 1,434,915 | 37% |
| Southeastern Wisconsin | | | | |
| Kenosha County | 50,900 | 71,000 | 20,100 | 39% |
| Northwestern Indiana | | | | |
| Lake County | 188,261 | 215,650 | 27,389 | 15% |
| Porter County | 46,341 | 67,050 | 20,709 | 45% |
| LaPorte County | 44,785 | 50,700 | 5,915 | 13% |
| Total | 279,387 | 333,400 | 54,013 | 19% |

¹ The source of the data in this table are the official forecasts of the regional planning agencies, the Northeastern Illinois Planning Commission (NIPC), the Southeastern Wisconsin Regional Planning Commission, and the Northwestern Indiana Regional Planning Commission.

² The NIPC forecasts shown in this table are one of two forecast files adopted by NIPC. The forecasts shown assume all aviation demand to be accommodated by existing airports. A second file, not shown, assumes the addition of a new airport in the south suburbs.

The Northwest Indiana Experience

The goals of biodiversity recovery in northwest Indiana reflect a region of contrasts, dilemmas and hope.¹ Rich and extensive natural resources such as dunes, marshes, and savannas are contrasted with an industrial complex whose pollution discharges were relatively unchecked for decades. The region faces the challenges of recovering from the loss of high paying jobs and the decline of a productive industrial economic base. It also faces the pressures of rapidly growing suburban communities at the same time that inner city neighborhoods are experiencing disinvestment and decline. Amidst these contrasts and dilemmas are a changing culture that highly values environmental protection and an industrial community which has become more willing to work to balance environmental and economic development objectives.

Northwest Indiana generally is bounded by the Kankakee River on the south, the Lake Michigan shoreline on the north, the Illinois State line on the west, and the Valparaiso Moraine on the east. The Calumet area in the west portions of northwest Indiana includes the watersheds of the Little Calumet and Grand Calumet Rivers. About one third of the 45 miles of Lake Michigan shoreline and its adjoining natural resources are publicly owned by the municipal, state or federal government. Included in this area are the Indiana Dunes National Lakeshore and the Indiana Dunes State Park which together preserve over 15,000 acres of shoreline and large sand dunes. Most of the dunes are covered by deciduous forest while the ones closest to the lake are grass-covered or bare and wind-blown. Behind the dunes are interdunal ponds, marshes and wooded swamps. More than 1,300 native plants grow in the Indiana Dunes National Lake Shore, which has the third largest number of plant species in the entire national park system. The varying habitat of the dunes area and the presence of Lake Michigan, with its influence on migration, provides regular resting, nesting and wintering areas for at least 271 species of birds.

Late in the 19th century, industry also found the lakeshore, rivers and land (inexpensive and non-agricultural) attractive for steel mills, refineries, chemical plants and hundreds of smaller fabricating and subsidiary industries. Industrial development. In 1906, to build the U.S. Steel Gary Works on 9,000 acres of Lake Michigan shoreline, they moved as much dirt as was moved for the Panama Canal, diverted a river ½ mile from its natural course, laid a tunnel 80 feet deep and 9 miles out into Lake Michigan, and constructed a mile-long break-water that used mountains of concrete and 160,000 tons of steel. The National Steel Company Midwest Division and Bethlehem steel plants were built last in the 1960's. Because of the industrial pollution that resulted from this industrial concentration, the U.S. Environmental Protection Agency (EPA) considers this area to have the greatest concentration of environmental problems in the Midwest and initiated intensive enforcement action against violators of pollution control laws. The U.S. EPA has also designated eight Superfund sites (toxic contamination) in northwest Indiana. Unfortunately, there are far more concentrations of hazardous waste. For example, the Superfund sites do not include the Indiana Harbor and Ship Canal, where discharges of wastes by industry and municipal sewage treatment plants have built up a 20 foot layer of toxic sediment totaling 3.5 million cubic yards.

During the 1990's, through the efforts of both the federal, state, and local governments, with a strong participation of citizen environmental groups, there has been a fundamental shift toward a more cooperative relationship between the economic interests in northwest Indiana and those striving to protect and restore their natural resources. Rather than simply fining or penalizing industrial polluters, a process has been initiated whereby joint, cooperative and integrated solutions are pursued on a comprehensive ecosystem basis. Lee Botts refers to this as a "cross-media" approach. It is a shift away from individual penalties for water or air or groundwater pollution to one considering the total environmental effect of an action. Where a different industrial practice might curtail (as required) direct discharge, an alternative waste disposal method could increase air pollution. Alternatives to air pollution control practices might have led to increased ground water contamination. Instead, an approach of examining and investing in comprehensive solutions to pollution problems is being pursued as a joint process among the industries, the U.S. EPA and citizen environmental groups. Some are formalized in "Consent Decrees"

(Continued on next page.)

negotiated between enforcement agencies, the violators of pollution control laws and the courts. Today, more actions are voluntary because industries have learned that waste prevention promotes production efficiency. The first major consent decree in 1992, USX corporation agree to spend \$33 million for pollution control and for pollution prevention needed to comply with environmental standards. In a second Consent Decree in 1996, USX committed to spend \$90 million for cleaner coke oven processes, removal of contaminated sediments from the Grand Calumet River and other clean-up necessary because of past practices. This time another \$100 million was committed to go beyond what the letter of the laws requires. With the growing agreement that prevention is cheaper than dealing with waste after it has been created and that production must become more sustainable, now more companies are forming partnerships with private groups and government agencies in voluntary restoration and preservation projects.

¹ *The contrasts and dilemmas described here are well documented in The Environment of Northwest Indiana (PAHL's Inc., Valparaiso, Indiana, 1993). The facts about the Indiana Dunes and the industrial development impacts in the area were drawn mostly from The Indiana Dunes Story (Shirley Heinze Environmental Fund, Michigan City, Indiana, 1997). The hopes described here were derived from interviews in January, 1999 with Lee Botts (Indiana Dunes Environmental Learning Center) and Mark Reshkin (Northwest Indiana Forum Foundation, Inc. and former Chief Scientist at the Indiana Dunes National Lakeshore).*

ago and 65 close-in Illinois suburbs have lost population since 1990. If the trend towards sprawl is coupled with the population growth expected for the Chicago Wilderness region in the first two decades of the 21st century, we will see many more people occupying much, much more land.

Sustainability becomes a critical issue when looking to the future growth of this region. Serving an increasingly dispersed population while maintaining the social and economic fabric of established communities will require substantial and increasing levels of public investment. The threats to air, soil, and water quality implicit in this growth pattern are potentially severe. Both economic and environmental factors thus threaten the overall quality of life in northeastern Illinois. Failure to address traffic delays, mismatch between the locations of jobs and housing, environmental quality, and the costs of disinvestment will pose risks to the region's economic competitiveness. While not unduly limiting the choices of location that households and business make in the marketplace, the region must seek ways to preserve both the natural and built resources it already has and to encourage new growth to take more sustainable forms.

3.2.4 Region-wide efforts for meeting challenges from growth

Concomitant with this Biodiversity Recovery Plan, region-wide planning efforts are underway in each of the three states included in the Chicago Wilderness region.

The Northeastern Illinois Planning Commission is pursuing a Regional Growth Strategy, which includes the development and support of public policy that promotes sustainable growth, with balanced development responsive to the limitations of the region's natural resources and the need to improve environmental quality. This growth strategy includes support for the Regional Greenways Plan, which preserves and enhances regional biodiversity with 4300 miles of environmental corridors throughout the six-county northeastern Illinois area.

In Wisconsin, regional plans for land use and for the protection and management of natural areas and critical species habitats, products of the Southeastern Wisconsin Regional Planning Commission, have outlined detailed strategies to moderate regional decentralization and to preserve environmental corridors and other areas. The Wisconsin plan specifically identifies 474 square miles for planned natural-area protection. The Northwestern Indiana Regional Planning Commission is developing a vision for the year 2020 that encompasses land-use patterns, the transportation system, the social and economic fabric of the area, and an environmental sensitivity that produces a high quality of life for the region. Other discussions underway and proposals for sustainable development in the Chicago Wilderness region include the 2020 Chicago Metropolis Project, the Strategic Open Lands at Risk Project, the Campaign for Sensible Growth, and the Illinois Growth Task Force. See sidebar describing northwest Indiana's struggle for environmental quality.

Recommendations

- ✓ Support the Regional Greenways Plan for northeastern Illinois and the Natural Areas Plan for southwestern Wisconsin. These plans identify actions to protect and manage critical habitats for plants and animals and generally to improve ecosystems. They complement and support the objectives of this Recovery Plan.
- ✓ Participate in the discussions of the Campaign for Sensible Growth and Metropolis 2020. The Campaign promotes principles of economic development, redevelopment, and open space preservation. Metropolis 2020 has proposed actions to help the region develop in a manner that protects its economic vitality, while maintaining its high quality of life.
- ✓ Support implementation of regional growth strategies by the Northeastern Illinois Planning Commission, the southeastern Wisconsin Regional Planning Commission, and the Northwest Indiana Regional Planning Commission, insofar as these plans seek to reduce the region's excessive rate of land consumption, preserve important open spaces, and promote improved water quality.

3.3

The impact of development on ecosystems

3.3.1 Introduction

Development of land for urban uses is the primary threat to the remaining unprotected natural lands of our region, and in some cases it is causing serious degradation of protected lands as well.

Impacts on biodiversity by the continuing growth and decentralization of the greater Chicago region can be visualized in several ways. One effective approach is to picture the ecosystem in three layers, as illustrated in Figure 3.1.

The top layer is ecological health of living communities, which can be measured by the long-term viability of the species and ecological communities of the region, their genetic diversity and ability to reproduce. This layer is reflected in discussions of the status of communities contained in chapters 5 and 6.

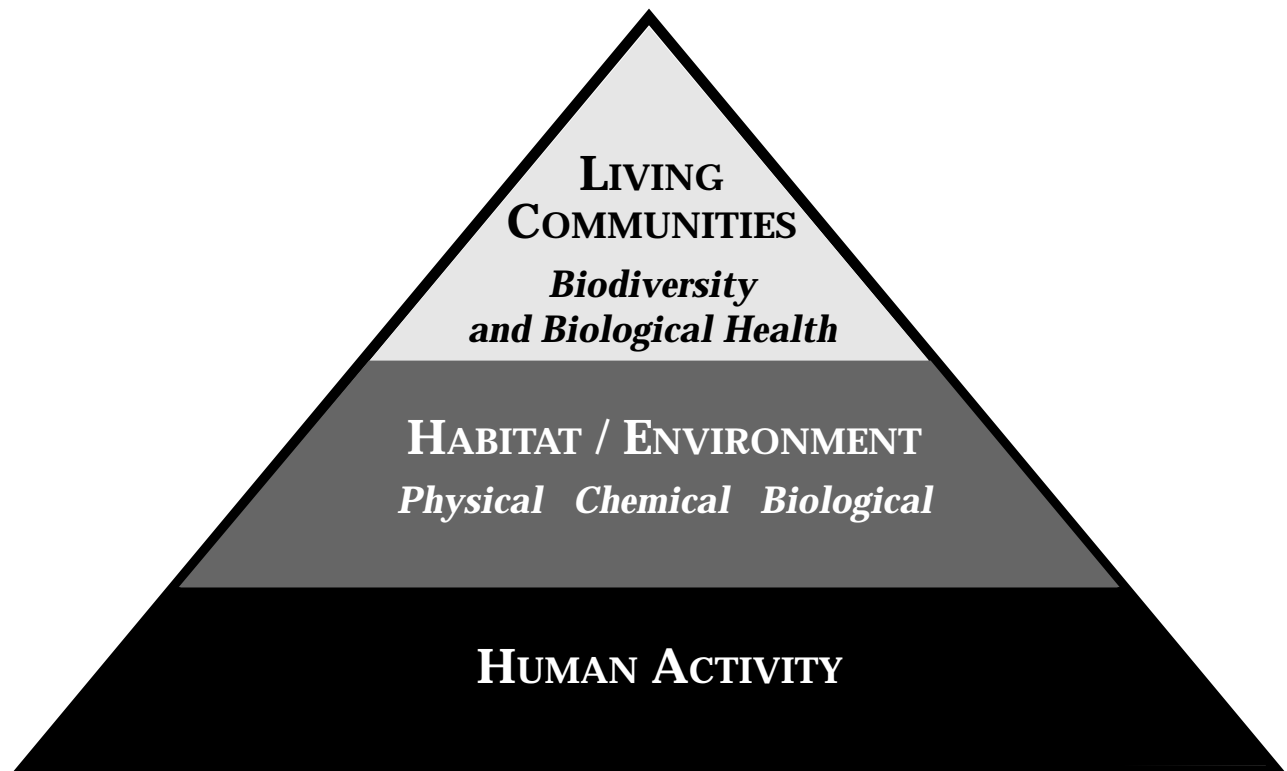


Figure 3.1 Ecosystem health and human activity

The second layer is the health of the supporting environment, which can be measured by the integrity of physical, chemical, and biological habitat and ecological processes. This environmental layer contains the elements that support life and also things that place stress upon life. For example, water is essential for living things, but too much water can be stressful and even fatal. The key stressors that threaten our ecological communities are discussed in chapters 5 and 6

The third layer is human activity that places stress on habitat and natural processes. For thousands of years, humans were a compatible part of the ecosystems of our region, but in the last 200 years, human activity has increased and is now so pervasive that no aspect of nature is left untouched. Nature can no longer freely take its course in our region. Our actions determine what will survive and what will not.

To understand what is happening to the region's natural communities, it is first necessary to understand the processes that supported them for thousands of years. Next it is necessary to understand how modern humans' activities have altered these processes and what can be done to restore them or compensate for the alterations.

The health of the various living communities in our region is discussed in Chapters 5 and 6, together with the status of needed habitats and the factors that affect them. Chapter 9 describes management tools available to overcome problems discussed below.

3.3.2 Natural processes and habitats

The central theme of this plan is that truly durable and resilient populations of all living organisms inhabiting the Greater Chicago Region require, above all else, the protection and rehabilitation of ecological habitats and the natural processes that sustain them. These natural processes provide the dynamic mix of nurture and stress needed to maintain ecological health.

In the region, the key processes and related factors are:

- Water
- Groundwater and soil moisture
- Watershed and stream hydrology
- Floodplain processes of inundation, channel movement, etc.
- Water quality, including chemistry, nutrient content, clarity, etc.
- Soil: structure, fertility, permeability, erosion and sedimentation

- Sunlight and microclimates: shade, shelter, weather, and climate
- Fire: its inhibition or promotion of various species
- Competition and natural balances: food-webs, herbivory, and predation
- Habitat size and connectivity: genetic flow and survival, corridors for migration and dispersal, and habitat diversity
- Pollination and seed dispersal

Many of the above elements and processes have been substantially altered by human activity since European settlement. They all still support or adversely affect the remnant natural communities that survived conversion of our landscape to farming and urban uses. Of greatest importance today are continuing changes in *hydrology* and *water quality*, the suppression of *fire*, and changes in *competition*, primarily the impact of invasive species resulting from human alteration of the environment and natural processes.

3.3.3 Hydrology and groundwater

Each of the region's natural communities has, over the course of several millennia, adapted to its own moisture environment. The Midwestern seasonal weather patterns include sporadic heavy rains, drought, freezing, and thawing. The effect of rain or snow varies with the permeability of the soil as well as the local topography.

Little of the rainfall on the original landscape of the area ran directly into streams, because most of it was absorbed by the soil aided by the native vegetation. The landscape included many wetlands, seasonal ponds, and areas with high groundwater. The streams were wide and shallow, fed by groundwater. Flow varied seasonally and in many cases ceased altogether during dry seasons. Water drained slowly from the relatively flat and heavily vegetated landscape, and much of it was transpired by plants without reaching streams at all. Streams rose and fell slowly and did not cut deep channels. Aquatic plants were more abundant than they are today and aquatic habitat was diverse. Living components of the region were adapted to, and dependent upon, the varying patterns and degrees of wetness produced by the hydrology of the area.

Draining the land for both agricultural and urban purposes resulted in vast changes. Draining lowered water tables and eliminated wetlands, ephemeral ponds, sedge meadows, and wet prairies. The amount of groundwater available, its depth, and the timing of moisture cycles changed, altering both soil moisture and the flow of

groundwater into streams. These changes reduced the diversity of both terrestrial and aquatic habitats.

As watersheds become urbanized, the increasing amounts of impervious surface and added drainage facilities make water flow “flashier.” This adds to peak storm flows and adds erosive energy, which changes the physical form of the stream and its suitability as habitat. The prevention of natural infiltration reduces groundwater while increasing stream volumes. The addition of wastewater also maintains stream levels during periods when they formerly would have been wetlands containing little or no flowing water. Stream flows have also been substantially affected by construction of dams and dredging of channels. These have changed both stream flows and groundwater.

Restoration and maintenance of groundwater and stream flows are essential to protecting natural areas and the few high-quality stream segments remaining in the region.

Urban wastewater disposal has also been a major factor in the degradation of the region’s streams, rivers, and lakes. Current federal and state standards governing the quality of wastewater discharges from point sources have helped to upgrade conditions throughout the region by removing pollutants. However, increases in the quantity of wastewater due to growth can cause adverse effects on aquatic communities.

Pollution is a well-documented, major stressor of aquatic systems in the form of sediment, excess nutrients, and toxic substances. Sediments can create problems such as burying spawning areas, choking small organisms, interfering with feeding, and blocking light from aquatic plants. Excess nutrients can cause excess plant growth, followed by oxygen depletion when algae or plants decay. Toxic substances can have both acute and chronic effects ranging from poisoning to long-term endocrine disruption including feminization of male organisms. Improved sewage treatment has greatly reduced acute affects, but many chronic effects linger and storm water still washes toxins into our streams. Roadway salt spray and salt runoff cause problems and possible adverse effects. Pollution effects on terrestrial systems are less well known. Increasing nitrogen deposition from airborne sources is an important research issue.

Farming has had major adverse impacts on natural communities in the past, including increasing the amounts and rates of storm flow from cultivated fields. However, agricultural land use generally supports better water quality and stream habitat than urban uses, in large part because agriculture leaves stream buffers and creates fewer impervious areas. Pollution from agricul-

tural sources has been reduced as a result of pesticide regulation and voluntary adoption of improved management practices. Good farm practices can considerably enhance stream quality while poor practices can result in degradation.

3.3.4 Soil formation, fertility, structure, permeability, erosion, and sedimentation

The soil of the region has formed since the melting of the Wisconsinan glaciation approximately 13,000 years ago. The raw material left by the glaciers consisted primarily of clay and sand from the bottom of glacial Lake Chicago and glacial till left in moraines and other glacial forms. The rich black soils of our area were formed by prairie plants with their deep and prolific root systems. Other soils formed under the influence of forests. Soil is formed over periods of time far beyond the reach of this plan, but changes in the soil caused by humans can occur rapidly. Soil compaction and loss of structure and permeability decrease the groundwater supply and increase runoff and flooding. Compaction can also destroy soil microorganisms, eliminate many native plant species, and make restoration difficult. Erosion is a visible problem in the form of new gullies in a few areas, but gradual loss of soil is a greater long-term concern because new soil forms so slowly.

Eroded soil causes major problems downstream, where it causes water turbidity and settles as sediment in wetlands, ponds, and rivers. Sedimentation is a major cause of habitat degradation in streams and wetlands. It clogs and buries essential habitat and makes restoration difficult. Also, invasive aquatic plant species often move into aquatic systems as a result of increased sedimentation.

3.3.5 Sunlight and microclimates

Each species is adapted to a range of intensity and duration of sunlight. Many of the native species of the region are adapted to the full sunlight of prairies or the scattered shade of open woodlands. Others are adapted to the heavier shade of closed forests. These various patterns of sunlight were maintained primarily by the forces of climate, fire, and browsing. The availability of sunlight at various levels within terrestrial communities and in aquatic communities is a powerful factor in their survival and is a key consideration in protection and restoration. Many management and restoration activities are aimed at ensuring the availability of the diverse mix of sunlight and shade needed to support the full range of species in each ecological community native to our region.

3.3.6 Fire

Fire is an essential force that shaped and sustained the natural ecosystems of the region. Whether started by lightning or native people, it favored vegetation that had evolved with fire and limited the extent of fire-sensitive trees, shrubs, and herbaceous plants, which would have otherwise out-competed most of the fire-adapted species. For example, most of the region's naturally dominant tree species need ample sunlight in their early stages. Their seedlings and saplings grow only when fire suppresses shade-producing vegetation. Sun-loving prairie communities also depend upon fire to suppress woody plants, which would otherwise produce ever-increasing shade. Fire also favors some species by providing conditions that stimulate their seed germination or growth.

The varying intensities and frequencies of natural fires contributed to the rich mosaic of the landscape. Virtually all of the regional landscape was influenced by fire to some extent and burned at least occasionally. Communities that are highly fire-dependent include prairies, shrublands, savannas, woodlands, and dry-mesic upland forests.

Fire suppression following settlement has greatly reduced the extent of fire-dependent communities and the former rich variety of habitats. Prairies, shrublands, and savannas have mostly disappeared, even from protected areas, while the surviving woodlands tend to be choked with brush and fire-intolerant trees, both native and exotic. The simplified and homogenized landscape offers little of the complex habitat needed by a wide variety of plants and animals native to the area. In woodlands and forests, secondary effects from fire suppression and invasion by "weedy" species include shading out of the ground flora and erosion where soil is exposed.

Fire suppression is obviously needed in non-natural areas to protect property, but wisely planned and managed fire is essential to restore and maintain the health of the fire-dependent communities of Chicago Wilderness. Returning fire to natural areas in the form of prescribed burns offers the opportunity to return an essential natural process and major force of nature to the landscape.

3.3.7 Competition and natural balance, food chains and predation

Each organism competes for habitat including the water, nutrients, light, and other ingredients necessary to growth and reproduction. The species found in the native communities of the region compete among themselves but are able to persist and even create conditions that are favorable for each other. Some species depend on the presence of others in a variety of relationships ranging

from parasitism to symbiosis. Competition is seldom a matter of overwhelming advantage, but rather a matter of slightly better ability to make use of the habitat. Species within a community are usually in dynamic balance, changing in vigor and abundance as conditions change from year to year. In healthy communities, disturbance can be absorbed without permanent loss, although the diversity within the community may be reduced if some species no longer find the habitat they need. Over time, the needed conditions may reappear, allowing the missing species to return, or the new conditions may admit previously excluded species. In either case, complexity is restored. In this sense the communities tend to be self-organizing within a dynamic balance.

As species from outside of the region and around the world are introduced into the area, they compete for habitat. In most cases, they either fail to survive or find a niche without disrupting the native communities. In a few cases, they find major advantage over the native species and become invasive, choking out the native species and unbalancing the native community. This is the current situation with species such as buckthorn, garlic mustard, and purple loosestrife.

Invasive species, many of them exotic, are having a huge adverse impact on native flora and fauna in both unprotected and protected areas. In many cases, the effect is magnified by the disruption of natural processes, but some exotic species successfully invade even in the absence of major disruption, e.g., wood-boring beetles, Dutch elm disease, and carp. The short-term need is to control and eliminate invasive exotics before they become widespread. The long-term need is to prevent future introductions of new exotic species and to take quick action to control any new invasions.

Native species can also become invasive and have adverse impacts on natural communities if ecological processes are disrupted. A prime example is the spreading of fire-intolerant trees such as maples into oak groves and prairies as a result of fire suppression. Native species can also become invasive if natural predators are absent. Perhaps the best example of this is the white-tailed deer. In the absence of predators, the herds have grown far beyond the carrying capacity of the land and are adversely affecting native plant species and communities throughout much of the region. Raccoons, opossums, and cats are also abundant due to human activities and a lack of predators, and they are adversely affecting populations of small animals and ground-nesting birds.

The loss of a species can break a food chain, leaving other species without food or without a consumer to limit their spread. Loss of large predators has contributed to excessive populations of smaller predators and deer, as noted

above. The endangered Karner blue butterfly is an example of a species that can be left stranded on a broken food chain. This butterfly relies exclusively on the wild lupine as a food plant during its larval stage, a factor that contributes to its rarity. Many other species depend on plants that occur only, or primarily, in remnant natural areas.

3.3.8 Habitat size

The size of available habitat is an essential factor for long term health and survival of species and ecological communities. The many aspects of habitat size are encapsulated within the concept of island biogeography. These aspects include patch size, habitat diversity, connectedness, genetic flow, migration, dispersal, and survival of keystone species. The theory of island biogeography has become well developed and reported in scientific literature. For an easily read, but thorough presentation, see Quammen (1996).

For long-term viability, a population must maintain genetic diversity. Otherwise, it can become inbred, losing its ability to adjust to change, to survive a disease, or to reproduce. A population must also be large enough so that it is not simply wiped out by an event such as an unusual storm. In addition to genetic diversity and size, a population needs access to diverse habitat. Some species need different habitats during different life stages. Also, habitat itself can vary from year to year due to weather or other disturbances. Partial compensation for small size can be made by connections between populations. However, corridors can also have disadvantages such as providing avenues for movement of exotic species.

Some species require a large area as a home range. In the Chicago Wilderness area, these included large predators such as bears and wolves and large herbivores such as elk and buffalo. The interactions among such animals and their food (plants or prey) are only partially understood, but the large animals no doubt had substantial effects on food chains, habitat, and species abundance. Some relatively large predators such as marsh hawks and short-eared owls are now rare, but could be restored by restoring needed habitat.

The study of island biogeography has brought clearer understanding to the limits of relatively small areas and populations. In many respects, knowledge of island biogeography applies to the remnant natural areas of the Chicago Wilderness region because they are an archipelago of biological islands. They have become islands as the land around them is used for agriculture or urban development. But they are also being further divided into smaller islands as essential habitat is lost due to interruption of natural processes and displacement by invasive species. From this perspective, the natural areas of

Chicago Wilderness are not only islands that are losing species according to the natural laws that apply to islands; they are shrinking islands that will support progressively fewer species and biodiversity in the future. The realization that biodiversity is being lost due to fragmentation of habitats is relatively recent, as is the realization that management can restore natural communities.

Many aspects of island biogeography apply wherever habitat is shrinking or being divided. This includes even aquatic habitats. Although water connects stream habitats, both physical and chemical changes can act as barriers that divide streams into smaller pieces of habitat.

A major finding of this plan is that the remnant populations of native plants and animals of the region are in great danger of being lost, in part because critical habitats in our natural areas have become shrinking islands. This threat can be addressed through twin activities of protecting more natural areas and managing the land to restore habitat.

As discussed in Chapter 5, there is a great need for large sites with varied habitat. However, some of the need can be met by connecting fragmented habitats with corridors adequate for migration and dispersal.

3.3.9 Pollination and seed dispersal

For a plant population to survive, pollen must reach flowers and seed must be dispersed. Wind disperses pollen and seeds for some species, but many others rely on far more specific vectors, such as insects, birds, and mammals. For example, the prairie white fringed orchid relies on the rare sphinx moth for pollination. As another example, seeds of some plants need to pass through the digestive system of a bird or mammal in order to germinate.

3.3.10 Stresses on ecological communities

Section 3.3 has discussed both natural processes and the human activities that exert stress on natural communities. Chapters 5 and 6 discuss the status of each type of natural community in our region and the stressors that affect that community type. In considering how to protect and restore ecological communities and their species, it is often useful to analyze the processes involved, including stressors and their sources (which are often human activities). For example, the hydrological cycle (a process) now includes reduced groundwater (a stressor) and farm tiles (a major source of the problem).

Stressors are summarized below.

Ecological processes exert stress on populations, but native organisms have been subject to those stresses for such a long time that they are adapted to them. Such stresses may be beneficial and even necessary for some species and communities. By comparison, stresses from our industrial society have been present for decades rather than millennia. Where land has been developed for agricultural and urban uses all, but a few of the thousands of native species have been eliminated except in remnant natural areas. Even in the remnant areas, native species and communities will not survive unless natural processes are restored or simulated through management. Humans are part of the ecosystem, but unless we manage our activities intelligently, we will find ourselves in an impoverished landscape. Instead of the former rich tapestry of life, our surroundings will be a small number of weedy species that can survive frequent disruption.

Human activities that affect natural processes

Stressors from human activities that reshape natural processes and are most threatening to the sustainability of ecological communities include:

- Development that fragments habitats and isolates populations
- Urban development: soil compaction, accelerated runoff, erosion
- Poor farming practices: soil compaction, accelerated runoff, erosion
- Hydrological modification of streams and drainage of land
- Dredging and filling of wetlands
- Fire suppression and resulting excessive shade
- Introduction of non-native species
- Pollution by toxic substances, excess nutrients, and sediment
- Increase in animals favored by urban conditions, e.g., deer, raccoons and cats, leading to excessive browsing or predation
- Removal of native vegetation
- Excessive collection of plants, seed, and animals including reptiles and amphibians
- Nighttime lighting, which disrupts normal behavior and draws migrating birds to collide with structures

Direct loss of natural areas

The most direct threat to many natural communities remains the common bulldozer. While many of the remaining natural communities are located on protected lands, others are still subject to development and typically lack adequate protection, whether by cooperative agreements or by local, state, or federal authority. The identification of still-unprotected natural communities and arrangements to protect them are work in progress. Once identified, the preservation of unprotected sites will merit very high priority.

3.4

Urban biodiversity

The seeming oxymoron of “urban biodiversity” lies at the heart of the situation and the opportunity in the Chicago Wilderness region. Treasures remain, yet the treasures are at risk. The greatest risks are the result of human activity, yet the means of protection lie in the resources of the urban population and its institutions.

While development has had widespread adverse impact on natural communities and biodiversity, it has also provided the financial and human resources for protecting and restoring what remains. The question is whether the people and institutions of the region will take the needed action.

Forest preserves and other passive recreational areas, together with natural areas left undeveloped for a variety of reasons, have provided a refuge for native biodiversity. The biodiversity surrounding Chicago far exceeds that found in the Midwest’s agricultural areas, where essentially all land is used for crop production. It was the urban economy and value system that made protection of natural areas possible. Now we must ensure that essential further acquisition and management take place.

Although the remnants of the original Chicago Wilderness are declining, it is not too late to restore and protect their beauty and biological integrity; it is not too late to ensure survival of a complete spectrum of the original natural communities of the region. The heritage of investments made during earlier development, together with the vast resources of the urbanizing region, provides the platform enabling us to make a choice.